

WHAT IS CLAIMED IS:

- 1           1.       A method for initializing a storage device comprising multiple storage units  
2 through a storage controller, comprising:  
3           receiving a request to initialize a storage space that spans the storage units;  
4           determining a layout of sets of sequential data blocks of the storage space onto the  
5 storage units, wherein sets of sequential data blocks are written across the storage units;  
6           for each set of sequential data blocks, performing:  
7               (i) determining a block address in each storage unit where a first data block in  
8 the set of sequential data blocks will be written; and  
9               (ii) generating a write command for each of the storage units, wherein each  
10 write command indicates the determined block address for the storage unit and a block  
11 number; and  
12               (iii) transmitting the write command with one block of initialization data to the  
13 storage unit, wherein the storage unit receiving the write command writes the block of  
14 initialization data from the indicated block address and writes the block of initialization  
15 data to each subsequent consecutive block in the storage unit a number of times equal  
16 to the block number.
- 1           2.       The method of claim 1, wherein the determined layout includes multiple sets of  
2 sequential data blocks written to each storage unit, wherein the sequential data blocks of each  
3 set written to one storage unit are non-consecutive with respect to the sequential data blocks in  
4 adjacent sets written to the storage unit.
- 1           3.       The method of claim 1, wherein the initialization data comprises zero data for  
2 the block.

1           4.       The method of claim 1, wherein the storage units comprise hard disk drives  
2       within a disk array, and wherein the sets of sequential data blocks comprise portions of a stripe  
3       of data written across the storage units, wherein multiple stripes are written across the storage  
4       units.

1           5.       The method of claim 1, further comprising:  
2       indicating in the write command a code to cause the storage unit receiving the write  
3       command to write an error correction code to each block to which the initialization data is  
4       written.

1           6.       The method of claim 5, wherein the code indicated in the write command  
2       further causes the storage unit receiving the write command to perform:  
3       combining the block address of the block to which the error correction code is written  
4       with the error correction code.

1           7.       The method of claim 5, wherein the error correction code written by the  
2       storage unit comprises a longitudinal redundancy check (LRC) code computed by performing  
3       an exclusive OR operation with respect to all the data in the block to which the error correction  
4       code is written.

1           8.       The method of claim 1, wherein the data block comprises a sector including at  
2       least a header section, a user data section, and an error correction code section.

1           9.       The method of claim 1, further comprising:  
2       determining for each set of sequential data blocks a sequence number in each storage  
3       unit where a first data block in the set of sequential data blocks will be written, wherein each

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4 data block in the storage space is assigned a sequential number indicating a location in the  
5 storage space relative to all other data blocks; and  
6 indicating in the write command the determined sequence number to cause the storage  
7 unit to write the sequence number of the data block in the storage space to each data block to  
8 which initialization data is written.

1 10. A method for initializing a storage unit that comprises one of multiple storage  
2 units managed by a storage controller, comprising:  
3 receiving a write command with one block of initialization data from the storage  
4 controller to initialize a set of sequential blocks in a storage space, wherein the write command  
5 indicates a block address in the storage unit where a first data block in the set of sequential data  
6 blocks will be written and a block number;  
7 writing the block of initialization data transmitted with the write command to the  
8 indicated block address; and  
9 writing the block of initialization data to each subsequent consecutive block in the  
10 storage unit following the indicated block address a number of times equal to the block number.  
11

1 11. The method of claim 10, wherein each storage unit receives multiple write  
2 commands to initialize multiple sets of sequential data blocks in the storage unit, wherein the  
3 sequential data blocks of each set written to one storage unit are non-consecutive with respect  
4 to the sequential data blocks in adjacent sets written to the storage unit.

1 12. The method of claim 10, wherein the storage units comprises a hard disk drive  
2 within a disk array, and wherein the sets of sequential data blocks comprise portions of a stripe  
3 of data written across the storage units in the array, wherein multiple stripes are written across  
4 the storage units.

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1           13.    The method of claim 10, further comprising:  
2           writing an error correction code to each block to which the initialization data is written.

1           14.    The method of claim 13, wherein writing the error correction code further  
2 comprises:  
3           combining the block address of the block to which the error correction code is written  
4 with the error correction code.

1           15.    The method of claim 1, wherein the data block comprises a sector including at  
2 least a header section, a user data section, and an error correction code section.

1           16.    A system for initializing a storage device comprising multiple storage units,  
2 comprising:  
3           means for receiving a request to initialize a storage space that spans the storage units;  
4           means for determining a layout of sets of sequential data blocks of the storage space  
5 onto the storage units, wherein sets of sequential data blocks are written across the storage  
6 units; and  
7           means for performing, for each set of sequential data blocks:  
8               (i) determining a block address in each storage unit where a first data block in  
9               the set of sequential data blocks will be written; and  
10               (ii) generating a write command for each of the storage units, wherein each  
11               write command indicates the determined block address for the storage unit and a block  
12               number; and  
13               (iii) transmitting the write command with one block of initialization data to the  
14               storage unit, wherein the storage unit receiving the write command writes the block of  
15               initialization data from the indicated block address and writes the block of initialization

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16 data to each subsequent consecutive block in the storage unit a number of times equal  
17 to the block number.

1 17. The system of claim 16, wherein the determined layout includes multiple sets of  
2 sequential data blocks written to each storage unit, wherein the sequential data blocks of each  
3 set written to one storage unit are non-consecutive with respect to the sequential data blocks in  
4 adjacent sets written to the storage unit.

1 18. The system of claim 16, wherein the initialization data comprises zero data for  
2 the block.

1 19. The system of claim 16, wherein the storage units comprise hard disk drives  
2 within a disk array, and wherein the sets of sequential data blocks comprise portions of a stripe  
3 of data written across the storage units, wherein multiple stripes are written across the storage  
4 units.

1 20. The system of claim 16, further comprising:  
2 means for indicating in the write command a code to cause the storage unit receiving the  
3 write command to write an error correction code to each block to which the initialization data is  
4 written.

1 21. The system of claim 10, wherein the code indicated in the write command  
2 further causes the storage unit receiving the write command to combine the block address of  
3 the block to which the error correction code is written with the error correction code.

1 22. The system of claim 20, wherein the error correction code written by the  
2 storage unit comprises a longitudinal redundancy check (LRC) code computed by performing

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3 an exclusive OR operation with respect to all the data in the block to which the error correction  
4 code is written.

1 23. The system of claim 16, wherein the data block comprises a sector including at  
2 least a header section, a user data section, and an error correction code section.

1 24. The system of claim 16, further comprising:  
2 means for determining for each set of sequential data blocks a sequence number in each  
3 storage unit where a first data block in the set of sequential data blocks will be written, wherein  
4 each data block in the storage space is assigned a sequential number indicating a location in the  
5 storage space relative to all other data blocks; and  
6 means for indicating in the write command the determined sequence number to cause  
7 the storage unit to write the sequence number of the data block in the storage space to each  
8 data block to which initialization data is written.

1 25. A system for initializing data in response to a command transmitted by a storage  
2 controller, comprising:  
3 a storage unit;  
4 means for receiving a write command with one block of initialization data from the  
5 storage controller to initialize a set of sequential blocks in a storage space, wherein the write  
6 command indicates a block address in the storage unit where a first data block in the set of  
7 sequential data blocks will be written and a block number;  
8 means for writing the block of initialization data transmitted with the write command to  
9 the indicated block address in the storage unit; and  
10 means for writing the block of initialization data to each subsequent consecutive block in  
11 the storage unit following the indicated block address a number of times equal to the block  
12 number.

1           26.     The system of claim 25, further comprising:  
2                 means for receiving multiple write commands to initialize multiple sets of sequential data  
3     blocks in the storage unit, wherein the sequential data blocks of each set written to one storage  
4     unit are non-consecutive with respect to the sequential data blocks in adjacent sets written to  
5     the storage unit.

1           27.     The system of claim 25, further comprising:  
2                 a disk array including multiple storage units, wherein the storage units comprise a hard  
3     disk drive within, and wherein the sets of sequential data blocks comprise portions of a stripe of  
4     data written across the storage units in the array, wherein multiple stripes are written across the  
5     storage units.

1           28.     The system of claim 25, further comprising:  
2                 means for writing an error correction code to each block to which the initialization data  
3     is written.

1           29.     The system of claim 28, wherein the means for writing the error correction code  
2     further performs:  
3                 combining the block address of the block to which the error correction code is written  
4     with the error correction code.

1           30.     The system of claim 25, wherein the data block comprises a sector including at  
2     least a header section, a user data section, and an error correction code section.

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1           31.     An article of manufacture comprising code executed by a storage controller for  
2     initializing a storage device comprising multiple storage units by:  
3             receiving a request to initialize a storage space that spans the storage units;  
4             determining a layout of sets of sequential data blocks of the storage space onto the  
5     storage units, wherein sets of sequential data blocks are written across the storage units;  
6             for each set of sequential data blocks, performing:  
7                 (i) determining a block address in each storage unit where a first data block in  
8                 the set of sequential data blocks will be written; and  
9                 (ii) generating a write command for each of the storage units, wherein each  
10                 write command indicates the determined block address for the storage unit and a block  
11                 number; and  
12                 (iii) transmitting the write command with one block of initialization data to the  
13                 storage unit, wherein the storage unit receiving the write command writes the block of  
14                 initialization data from the indicated block address and writes the block of initialization  
15                 data to each subsequent consecutive block in the storage unit a number of times equal  
16                 to the block number.

1           32.     The article of manufacture of claim 31, wherein the determined layout includes  
2     multiple sets of sequential data blocks written to each storage unit, wherein the sequential data  
3     blocks of each set written to one storage unit are non-consecutive with respect to the sequential  
4     data blocks in adjacent sets written to the storage unit.

1           33.     The article of manufacture of claim 31, wherein the initialization data comprises  
2     zero data for the block.

1           34.     The article of manufacture of claim 31, wherein the storage units comprise hard  
2     disk drives within a disk array, and wherein the sets of sequential data blocks comprise portions



3 of a stripe of data written across the storage units, wherein multiple stripes are written across  
4 the storage units.

1 35. The article of manufacture of claim 31, wherein the code further causes the  
2 storage controller to perform:

3 indicating in the write command a code to cause the storage unit receiving the write  
4 command to write an error correction code to each block to which the initialization data is  
5 written.

1 36. The article of manufacture of claim 35, wherein the code indicated in the write  
2 command further causes the storage unit receiving the write command to perform:

3 combining the block address of the block to which the error correction code is written  
4 with the error correction code.

1 37. The article of manufacture of claim 35, wherein the error correction code  
2 written by the storage unit comprises a longitudinal redundancy check (LRC) code computed  
3 by performing an exclusive OR operation with respect to all the data in the block to which the  
4 error correction code is written.

1 38. The article of manufacture of claim 31, wherein the data block comprises a  
2 sector including at least a header section, a user data section, and an error correction code  
3 section.

1 39. The article of manufacture of claim 31, wherein the code further causes the  
2 storage controller to perform:

3 determining for each set of sequential data blocks a sequence number in each storage  
4 unit where a first data block in the set of sequential data blocks will be written, wherein each

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5 data block in the storage space is assigned a sequential number indicating a location in the  
6 storage space relative to all other data blocks; and  
7 indicating in the write command the determined sequence number to cause the storage  
8 unit to write the sequence number of the data block in the storage space to each data block to  
9 which initialization data is written.

1 40. An article of manufacture including code executed by a storage unit for  
2 initializing the storage unit executing the code, wherein the storage unit is one of multiple storage  
3 units managed by a storage controller, wherein the code causes the storage unit to perform:  
4 receiving a write command with one block of initialization data from the storage  
5 controller to initialize a set of sequential blocks in a storage space, wherein the write command  
6 indicates a block address in the storage unit where a first data block in the set of sequential data  
7 blocks will be written and a block number;  
8 writing the block of initialization data transmitted with the write command to the  
9 indicated block address; and  
10 writing the block of initialization data to each subsequent consecutive block in the  
11 storage unit following the indicated block address a number of times equal to the block number.  
12

1 41. The article of manufacture of claim 40, wherein each storage unit receives  
2 multiple write commands to initialize multiple sets of sequential data blocks in the storage unit,  
3 wherein the sequential data blocks of each set written to one storage unit are non-consecutive  
4 with respect to the sequential data blocks in adjacent sets written to the storage unit.

1 42. The article of manufacture of claim 40, wherein the storage unit comprises a  
2 hard disk drive within a disk array, and wherein the sets of sequential data blocks comprise

3 portions of a stripe of data written across the storage units in the array, wherein multiple stripes  
4 are written across the storage units.

1 43. The article of manufacture of claim 40, wherein the code further causes the  
2 storage unit to perform:  
3 writing an error correction code to each block to which the initialization data is written.

1 44. The article of manufacture of claim 43, wherein writing the error correction  
2 code further comprises:  
3 combining the block address of the block to which the error correction code is written  
4 with the error correction code.

1 45. The article of manufacture of claim 40, wherein the data block comprises a  
2 sector including at least a header section, a user data section, and an error correction code  
3 section.

1 46. A computer readable medium including a command used for initializing a  
2 storage unit that comprises one of multiple storage units managed by a storage controller,  
3 wherein the command is associated with the following data:  
4 one block of initialization data used to initialize a set of sequential blocks in a storage  
5 space;  
6 a block address in the storage unit where a first data block in the set of sequential data  
7 blocks will be written; and  
8 a block number, wherein the command causes the storage unit to write the block of  
9 initialization data to the indicated block address and to each subsequent consecutive block in  
10 the storage unit following the indicated block address a number of times equal to the block  
11 number.

1           47.     The computer readable medium of claim 46, wherein the storage units  
2     comprises a hard disk drive within a disk array, and wherein the sets of sequential data blocks  
3     comprise portions of a stripe of data written across the storage units in the array, wherein  
4     multiple stripes are written across the storage units.

1           48.     The computer readable medium of claim 46, wherein the command further  
2     includes:  
3           data indicating whether to write an error correction code to each block to which the  
4     initialization data is written.

1           49.     The computer readable medium of claim 46, wherein the data blocks that are  
2     initialized each comprise a sector including at least a header section, a user data section, and an  
3     error correction code section.

1           50.     The computer readable medium of claim 46, wherein the initialization data  
2     comprises zero data for the block.

1           51.     The computer readable medium of claim 46, further comprising:  
2           a determined sequence number, wherein each data block in the storage space is  
3     assigned a sequential number indicating a location in the storage space relative to all other data  
4     blocks.

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